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The editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE MERCHANTS' ASSOCIATION AND THE JEROME PARK RESERVOIR.

The Merchants' Association of this city abundantly justified its existence and earned the everlasting gratitude of the municipality when it ran to earth and effectually killed that most colossal fraud of the last Tammany administration known as the "Ramapo steal." The Association is doing disinterested and noble work in standing guard over the city's interests and maintaining a careful watch for the incipient evidences of actual fraud or culpable negligence in the administration of municipal affairs. The need for such an association is pressing; its members are leading citizens of unquestioned integrity, and no one doubts for a moment the high character of its aims and the singleness of purpose with which they are followed. Although the Association has at times been misled, as it has to a certain extent in its attitude in the present Jerome Park reservoir controversy, the mistakes have been due to the fact that the subject of them was, as in the present case, a highly technical matter, in which the Commission was entirely dependent upon more or less interested technical advisers for its actual or supposed facts. The present attempt of the Association to bring about the impeachment of the Aqueduct Commissioners is not, however, altogether unjustified by the circumstances; for we defy anyone to prove that the interminable delay that has taken place in the construction of Jerome Park reservoir would have been possible, had the Aqueduct Commissioners under the former and present administration shown the proper amount of active interest in their duties. Had they taken the trouble to acquaint themselves fully with the condition of the work, and had they brought all possible pressure to bear upon Mr. McDonald, the contractor, there is not a doubt that the Jerome Park reservoir would have been now approaching completion and not, as it is, some three years behind contract time.

The attitude of the Merchants' Association toward the whole question of the Jerome Park reservoir is at once both right and wrong. We are heartily in sympathy with it in its endeavor to prove that there has been culpable *misfeasance*; at the same time we just as heartily disagree with it in its charge that there has been willful *malfeasance*. The Commission's sins are those of omission, not of commission, and in this respect it is to be placed in the same category with various other superfluous and practically useless commissions, such as that of the East River Bridge, which have encumbered the prosecution of great public works in this city. On the other hand, for proof that a commission, if it will but energetically discharge its duties, can be of enormous value to the city, witness the zeal of the Rapid Transit Commission, whose great work would have been consummated but for labor troubles in the closing days of the present year, or several months before the contract date. The Jerome Park reservoir contract, which was let over eight years ago, was to have been completed last November. At a recent public hearing, the contractor promised that one-half of the reservoir should be ready for water by the opening of the year, a promise that is simply preposterous in view of the present backward state of the work. After a personal visit to the reservoir we do not hesitate to say that the city may be thankful if the western half is finished within twelve months, and that it will be lucky if it gets the whole reservoir in working order within two years from the present writing.

Regarding the complaint of the Merchants' Association that unnecessary changes have been made in the plans of the work, to say nothing of the insinuations of incompetence or worse against the present Chief Engineer with which the complaint of the Association is so liberally seasoned, we have this to say: that, after a careful comparison of the old and new plans, and of the physical conditions existing both at Croton

Dam and Jerome Park, there is not only no ground whatever for these charges, but the changes as now being carried out are in every case based on sound engineering considerations, and are due to failure on the part of the engineers who drew up the first plans to fully appreciate the difficult nature of the sites upon which the reservoirs are built, and the conviction of the present Chief Engineer, that in constructing works of this magnitude and importance it is imperative that the work should be in accordance with the very latest engineering practice, and that the dam itself as completed, should be absolutely free from any possible cause of weakness or subsequent failure. As the work developed, it was found that if the original plans were followed, the core walls would have to be built upon a loose material which, under the hydraulic head of the impounded water, would run like so much quicksand. These core walls were immediately condemned, and in place of them solid masonry walls bedded everywhere upon good rock foundations were inserted. In the eyes of any unprejudiced engineer the change is so obviously necessary that the question of its utility does not admit of a moment's discussion. The other structural question, as to the advisability of substituting eight inches for three inches of concrete flooring over the whole of the reservoir, is also a purely technical one. If the whole floor of the excavated reservoir were formed of homogeneous material, a three-inch concrete finish would be sufficient; but where, as is now the case, the floor varies from solid or impervious rock to fissured and broken rock and filled or swampy ground, the proposal to put a thin three-inch concrete veneer over a floor of such a heterogeneous bearing quality, is doubtful on the face of it. To our thinking, the question is not whether eight inches is too much, but rather whether twice eight inches would be sufficient to provide an adequate and unbreakable floor over so variable a foundation.

There is no field of engineering that develops in the course of the execution of a great work so many unexpected obstacles and new conditions as that of the civil engineer, and there is no branch of civil engineering of which this is so emphatically true as that which is concerned with such works as the Croton dam and the Jerome Park reservoir. Plans for works of this character are always somewhat tentative and flexible, and when an engineer finds that in the development of the work, radical and far-reaching changes, involving heavy expenditure and a seeming, but not actual, reflection upon the judgment of his predecessor, are necessary, it is his bounden duty to make these changes. Such a course demands no little professional courage; for the engineer is well aware that his action, as in the present case, is liable to expose him to a great deal of ill-considered, extremely harassing and altogether unjust criticism.

The radical changes that have been made both in the Croton dam and in the Jerome Park reservoir are as necessary and commendable as the exasperating delay in executing these great works is inexcusable and deserving of the most searching criticism and judicial investigation that the Merchants' Association can bring to bear upon it.

CHICAGO DRAINAGE CANAL AND THE CITY OF ST. LOUIS.

The city of St. Louis is seeking to obtain a Federal injunction to prevent the city of Chicago from discharging its sewage by the way of the Chicago drainage canal into the Mississippi River, claiming that this diversion of the sewage is polluting the Mississippi, from which source the city of St. Louis obtains its water supply. It is pretty generally known (and if it is not it should be) that the great Chicago drainage canal was cut through at a cost of \$36,000,000 from Lake Michigan to the Illinois River for the purpose of carrying the sewage of Chicago into that river and securing its ultimate discharge into the Mississippi. Previous to the opening of the canal, the sewage of this great city of two million souls had been discharged into Lake Michigan, from which the city draws its water supply.

We have to go back nearly half a century to find the inception of this splendid work, when the project was mooted by E. S. Chesebrough, one of the best-equipped and most far-seeing sanitary engineers of his day; and in the interval it has been indorsed by such men as Prof. John H. Long, Rudolph Hering, George E. Waring, and other qualified authorities. The boldness and originality of the undertaking, its magnitude, and the extremely ingenious methods of excavation adopted in constructing the canal, attracted the attention of the whole civilized world, and the success of the scheme since its inauguration has been such that the Chicago drainage canal stands to-day as one of the most successful of the great engineering works of this or any other age. The proceedings in the suit of the State of Missouri and the city of St. Louis against the canal led to the carrying out by a commission of the Department of Health of Chicago of a very exhaustive examination of the flowing waters between Lake

Michigan at Chicago and the Mississippi River at St. Louis, with a view to determining their condition and quality before the opening of the drainage canal, as compared with their condition and quality after dilution with the waters flowing into them by way of the drainage canal. To insure that the facts of the investigation should be ascertained and presented truthfully and impartially, it was originally proposed that the examination should be made by three scientific institutions of high reputation, namely, the Washington University, St. Louis, Mo.; the University of Chicago, Ill.; and the Illinois State University, Ill.; triplicate samples of the waters being collected at the various points selected, and one set sent to each institution for examination. Subsequently it was proposed that for the greater satisfaction of St. Louis, the examination for that city be made in the laboratory of the St. Louis Water Commission. The two Illinois institutions signified their readiness to undertake the work; but as no response was made by the Mayor of St. Louis to the suggestion as affecting his city, the laboratory of the Sanitary District of Chicago filled the vacant place, and the examination was conducted on the triple lines as suggested above. Under the plan that was followed, every week samples of the water of the Illinois and Mississippi Rivers were collected from forty different stations commencing at Bridgeport, Illinois and Michigan Canal; and including La Salle, Illinois River; Peoria, Illinois River; Grafton, Mississippi River; and several points at St. Louis below the Missouri and below the city itself, the last sample being taken from the St. Louis city water supply.

The results of the investigation as gathered and presented in the report of Dr. S. Reynolds, Commissioner of Health, Chicago, clearly proved that running streams, if adequately diluted, do purify themselves from sewage pollution. This is proved by the complete disappearance of any trace of Chicago sewage in the Illinois River long before it reaches Averyville, and in the better quality of the Illinois River water as it merges into the Mississippi at Grafton than that of the Mississippi itself. It must be admitted that after reading carefully the report before us, the bugaboo of Chicago sewage injuriously affecting the drinking water at St. Louis is completely and effectually disposed of by the work of the investigators. The report of the Laboratory of the City of Chicago was made by Prof. Gehrman; that of the University of Chicago by Prof. Jordan; while Prof. Palmer reported for the University of Illinois. That the turning of the waters of Lake Michigan, even with the sewage of Chicago contained in them, into the Illinois and Mississippi Rivers has improved the quality of these waters is demonstrated indirectly by the fact that the State Fish Commissioner reports an enormous increase in the fish harvest. Fish that have been driven away from ever-increasing reaches of the river, year by year, by the undiluted sewage of the Illinois and Michigan Canal, and of the larger towns below Chicago, are returning to the purified waters, and the denizens along the banks of the Illinois, who were hitherto hostile to the canal, are now clamoring for the fullest flow of the channel in the interests of improved navigation. The majority of sanitary authorities are agreed that water under certain conditions is capable of self-purification; and in view of the fact that the present investigation has been conducted on a scale of larger magnitude than any similar inquiry that has preceded it, the results obtained may be considered conclusive; that is to say, it is now clearly proved that running water which is not too heavily charged with organic pollution will purify itself through the natural biochemical processes, of which bacterial action and insolation are the most important. Such is Dr. Reynolds' conclusion in his report, and he points out pertinently that "it must be conceded that unless this self-purification were true, there would be no such thing as pure water in streams affected by human habitancy." Among the many facts brought out in the investigation that prove the existence of a process of self-purification in running water, it may be mentioned in closing that a study of the death rate among the colon bacteria added to the river water in sewage combats the idea that typhoid bacteria will survive passage down the river; for it was found that the colon bacteria, which are present in large numbers in Chicago sewage—undoubtedly in much larger numbers than the typhoid bacilli—disappear almost completely in less than 150 miles flow. It is urged by Prof. Jordan that since all investigators are agreed that the colon bacillus is more hardy than the typhoid bacillus and can live in water for a longer time, there is every reason for supposing that the latter microbe dies out with at least the same rapidity

THE OLDEST MAP OF ROME.

There is preserved in Rome an interesting document, which is the oldest plan of the ancient city of Rome in existence. The Forma Urbis, as it is called, was cut upon 140 pieces of marble of various sizes, and